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Listing of Claims

This listing of claims will replace all prior versions and listings of claims in the application:

1. (previously amended) A process of making a composite article comprising:
providing a trilayer structure comprising:
 a first electrode layer,
 an electrolyte layer,
 a second electrode layer,
sintering the trilayer structure, wherein
said trilayer structure is hexagonal or tubular.
2. (original) A process of making a composite article as claimed in claim 1, wherein
the first electrode layer comprises one or more electronic and/or MIEC and an
ionic conductor or MIEC,
the electrolyte layer comprises predominately an ionically conducting electrolyte
material, and
the second electrode layer comprising one or more electronic and/or MIEC and an
ionic conductor or MIEC.
3. (original) A process of making a composite article as claimed in claim 2, wherein
the MIEC is non-reactive with the electrolyte layer material at the sintering
temperature of the composite article.
4. (previously amended) A process of making a composite article as claimed in
claim 1, wherein the first and/or second electrode comprise particles that are
larger than about .25 μm but less than about 10 μm , prior to sintering.

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5. (previously amended) A process of making a composite article as claimed in claim 1, wherein
the electrolyte layer has a porosity of less than 5% after sintering.
6. (previously amended) A process of making a composite article as claimed in claim 1, wherein
the electrode layers have a porosity of greater than 20 % but less than about 60% after sintering.
7. (original) A process of making a composite article as claimed in claim 1, wherein
the trilayer structure is affixed to a substrate.
8. (original) A process of making a composite article as claimed in claim 7, wherein
the substrate comprises a porous non-noble transition metal, a porous non-noble transition metal alloy or a porous cermet incorporating one or more of a non-noble non-nickel transition metal and a non-noble transition metal alloy.
9. (original) A process of making a composite article as claimed in claim 1, wherein
the sintering is conducted at a temperature sufficient to substantially sinter and densify the electrolyte layer without melting the electrodes.
10. (original) A process of making a composite article as claimed in either of claims 1 or 9, wherein the sintering is conducted at about 1000 °C to about 1500 °C.
11. (original) A process of making a composite article as claimed in claim 10,
wherein the sintering is conducted at about 1200 °C to about 1400 °C.
12. (original) A process of making a composite article as claimed in claim 11,
wherein the sintering is conducted at about 1250 °C to about 1350 °C.

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13. (original) A process of making a composite article as claimed in claim 1, wherein the sintered electrolyte layer is gas-tight and greater than about 90% densified.
14. (original) A process of making a composite article as claimed in claim 1, wherein the sintered electrolyte layer is gas-tight and greater than about 95% densified.
15. (original) A process of making a composite article as claimed in claim 1, wherein the sintered electrolyte layer is no more than 2% porous.
16. (original) A process of making a composite article as claimed in claim 1, wherein the sintered electrolyte layer is about 1 to 50 microns thick.
17. (original) A process of making a composite article as claimed in claim 16, wherein the sintered electrolyte layer is about 3 to 30 microns thick.
18. (original) A process of making a composite article as claimed in claim 17, wherein the sintered electrolyte layer is about 5 to 20 microns thick.
19. (original) A process of making a composite article as claimed in claim 1, wherein said trilayer structure is planar.
20. (original) A process of making a composite article as claimed in claim 1, wherein said trilayer structure is tubular.
21. (original) A process of making a composite article as claimed in claim 1, wherein said trilayer structure is hexagonal.
22. (original) A process of making a composite article as claimed in claim 7, wherein said substrate is an alloy selected from the group consisting of a low-chromium ferritic steel, an intermediate-chromium ferritic steel, a high-chromium ferritic steel, a chrome-based alloy, and chrome-containing nickel-based Inconel alloy.

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23. (original) A process of making a composite article as claimed in claim 22, wherein said alloy is selected from the group consisting of Cr5Fe1Y and Inconel 600.
24. (original) A process of making a composite article as claimed in claim 7, wherein said substrate material is a cermet selected from the group consisting of at least one of $\text{La}_{1-x}\text{Sr}_x\text{Mn}_y\text{O}_{3-\delta}$ ($1 \geq x \geq 0.05$) ($0.95 \leq y \leq 1.15$) ("LSM"), $\text{La}_{1-x}\text{Sr}_x\text{CoO}_{3-\delta}$ ($1 \geq x \geq 0.10$) ("LSC"), $\text{SrCo}_{1-x}\text{Fe}_x\text{O}_{3-\delta}$ ($0.30 \geq x \geq 0.20$), $\text{La}_{0.6}\text{Sr}_{0.4}\text{Co}_{0.6}\text{Fe}_{0.4}\text{O}_{3-\delta}$, $\text{Sr}_{0.7}\text{Ce}_{0.3}\text{MnO}_{3-\delta}$, $\text{LaNi}_{0.6}\text{Fe}_{0.4}\text{O}_{3-\delta}$, $\text{Sm}_{0.5}\text{Sr}_{0.5}\text{CoO}_{3-\delta}$, yttria stabilized zirconia (YSZ), scandia stabilized zirconia (SSZ), $(\text{CeO}_2)_{0.8}(\text{Gd}_2\text{O}_3)_{0.2}$ (CGO), $\text{La}_{0.8}\text{Sr}_{0.2}\text{Ga}_{0.85}\text{Mg}_{0.15}\text{O}_{2.825}$ (LSGM20-15), $(\text{Bi}_2\text{O}_3)_{0.75}(\text{Y}_2\text{O}_3)_{0.25}$ and alumina, in combination with at least one of transition metals Cr, Fe, Cu, Ag, an alloy thereof, a low-chromium ferritic steel, an intermediate-chromium ferritic steel, a high-chromium ferritic steel, a chrome-based alloy, and chrome-containing nickel-based Inconel alloy.
25. (original) A process of making a composite article as claimed in claim 24, wherein the LSM is selected from the group consisting of $\text{La}_{0.8}\text{Sr}_{0.2}\text{MnO}_{3-\delta}$, $\text{La}_{0.65}\text{Sr}_{0.30}\text{MnO}_{3-\delta}$, $\text{La}_{0.45}\text{Sr}_{0.55}\text{MnO}_{3-\delta}$.
26. (original) A process of making a composite article as claimed in claim 25, wherein said chrome based alloy is Cr5Fe1Y.
27. (original) A process of making a composite article as claimed in claim 1, wherein said electrolyte comprises at least one of yttria stabilized zirconia (YSZ), scandia stabilized zirconia (SSZ), doped cerium oxide including $(\text{CeO}_2)_{0.8}(\text{Gd}_2\text{O}_3)_{0.2}$ (CGO), $\text{La}_{0.8}\text{Sr}_{0.2}\text{Ga}_{0.85}\text{Mg}_{0.15}\text{O}_{2.825}$ (LSGM20-15) and $(\text{Bi}_2\text{O}_3)_{0.75}(\text{Y}_2\text{O}_3)_{0.25}$.

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28. (original) A process of making a composite article as claimed in claim 27,
wherein said electrolyte is yttria stabilized zirconia.
29. (original) A process of making a composite article as claimed in claim 28,
wherein said yttria stabilized zirconia is $(\text{ZrO}_2)_x(\text{Y}_2\text{O}_3)_y$ where $(.88 \geq x \geq .97)$
and $(.03 \leq y \leq .12)$.
30. (original) A process of making a composite article as claimed in claim 29,
wherein said yttria stabilized zirconia is at least one of $(\text{ZrO}_2)_{0.92}(\text{Y}_2\text{O}_3)_{0.08}$ and
 $(\text{ZrO}_2)_{0.90}(\text{Y}_2\text{O}_3)_{0.10}$.
31. (original) A process of making a composite article according to claim 1, wherein
the electrolyte is a mixed ionic electronic conductor.
32. (original) A process of making a composite article as claimed in claim 31,
wherein said electrolyte comprises at least one of $\text{SrCo}_{1-x}\text{Fe}_x\text{O}_{3-\delta}$ ($0.30 \geq x \geq$
 0.20), $\text{La}_{0.6}\text{Sr}_{0.4}\text{Co}_{0.6}\text{Fe}_{0.4}\text{O}_{3-\delta}$, $\text{Sm}_{0.5}\text{Sr}_{0.5}\text{CoO}_{3-\delta}$ and $\text{La}_{1-x}\text{Sr}_x\text{CoO}_{3-\delta}$.
33. (original) A process of making a composite article as claimed in claim 32,
wherein said electrolyte is $\text{SrCo}_{0.75}\text{Fe}_{0.25}\text{O}_{3-\delta}$.
34. (original) A process of making a composite article as claimed in claim 1, wherein
the composite article has an ohmic area specific resistance from about 0.5 ohm
 cm^2 to about .05 ohm cm^2 during operation of the composite article.
35. (original) A composite article made according to the process of claim 1, wherein
the composite article has an ohmic area specific resistance of from about 0.5 ohm
 cm^2 to about .25 ohm cm^2 during operation of the composite article.

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36. (original) A composite article made according to the process of claim 1, wherein the composite article has an ohmic area specific resistance of less than about .05 ohm cm² during operation of the composite article.
37. (cancelled) A solid oxide fuel cell made according to the process of claim 1.
38. (previously amended) A process of making a solid oxide fuel cell comprising:
providing a trilayer structure comprising:
 a first electrode layer,
 an electrolyte layer,
 a second electrode layer,
sintering the trilayer structure, wherein
said trilayer structure is hexagonal or tubular.